

# Using Historical Surveys to Detect Climate Change Effects on Birds and Mammals

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## Fact Sheet

### The Issue

Biodiversity, a measure of the variety of life on Earth, is regarded as an important indicator of ecosystem health. The current loss of biodiversity is occurring at a rapid and alarming rate, attributed to the alteration of species' habitats by human activities. Global climate change is anticipated to have enormous impacts on increasing future rates of biodiversity loss, including species extinctions. There is evidence that the geographic distributions and timing of life history events of flora (plants) and fauna (animals) have changed due to changes in climate. Scientists have hypothesized, often with dire predictions, about species' responses to continued climate change. Currently, the performance of predictive methods that infer beyond current climates is poorly known. Model uncertainty is the result of a poor understanding of species interactions. Given the current state of knowledge, using predicted changes in species ranges to guide policy decisions on climate change is risky. Better modeling methods are needed to help guide policy decisions to reduce the severity of climate change impacts on California's rich and unique biodiversity.

### Project Description

Using the unique Grinnell survey data, this project will test models designed to estimate changes in flora and fauna. The Grinnell survey, started in 1903 by Joseph Grinnell, is the largest and oldest historical survey database of small mammals and birds. This rich historical dataset has been complemented by resurveys along multiple elevational transects in national parks and forests in California. The funds will support a postdoctoral research scholar to build predictive models of faunal species distributions in the Sierra Nevada mountain range using previously collected field data. Access to the Grinnell resurvey data provides an exceptional opportunity to validate biological modeling in response to climate variables, and to evaluate alternative methods for forecasting species' responses to climate. There are numerous approaches to modeling species distributions, few of which have been critically tested for the ability to predict response to climate change.

The goals of this project are to:

- Build a model that will simulate historical changes in the geographic ranges of small mammals and birds in California due to climate change over the past century.
- Create an ensemble of the best models to predict the effects of climate change on small mammals and birds of California for the next 40 years.

### PIER Program Objectives and Anticipated Benefits for California

Changes in fauna contribute to changes in flora through plant-eating animals and seed dispersal. Vegetation, in turn, affects the hydrologic cycle as well as the Earth's surface reflection of solar



The "Yosemite Transect" of the original Grinnell survey.  
(Source: UC Berkeley)

radiation and heat. Vegetation in the Sierra Nevada mountain range, where the study sites are located, provides an important role in the preservation of the Sierra Nevada snowpack and erosion control. A greater understanding of California flora and fauna in future climates will provide water managers with better estimates on water supplies, which will have a large effect on energy generation. Understanding how flora and fauna may change in the future is also important for the development of realistic climate projections for California, which are needed to understand potential changes in energy demand and generation. Understanding the effects of climate change on vegetation is also important for identifying the capacity of California's future ecosystems to provide energy offsets in cap and trade markets related to forestry.

### Project Specifics

Contract Number: MRA-02-080

Contractor: UC Berkeley

Contract Amount: \$124,747

Contract Term: February 2009 to May 2011

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### Disclaimer

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